527 Rec'd PCT/PT 07 DEC 2000

FORM PTO-1390 (REV. 5-93) | U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE | ATTORNEY'S DOCKET NUMBER 10191/1566

TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371

U.S. APPLICATION NO. (If known, see 37 CFR 1.5) 09/719118

INTERNATIONAL APPLICATION NO.	INTERNATIONAL FILING DATE (28.03.00)	PRIORITY DATES CLAIMED (07.04.99)
PCT/DE00/00935	28 March 2000	7 April 1999

TITLE OF INVENTION
TEMPERATURE SENSOR HAVING AT LEAST ONE CONDUCTOR TRACK AND METHOD FOR THE MANUFACTURE OF A TEMPERATURE SENSOR

APPLICANT(S) FOR DO/EO/US
SCHULTE, Thomas; BRINZ, Thomas and WEBER, Lothar

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information

1. ☒ This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. ☐ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3. ☒ This express request to begin national examination procedures (35 U.S.C. 371(f)) at any time rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 371(b) and PCT Articles 22 and 39(1).
4. ☐ A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date.
5. ☒ A copy of the International Application as filed (35 U.S.C. 371(c)(2))
   a. ☐ is transmitted herewith (required only if not transmitted by the International Bureau).
   b. ☒ has been transmitted by the International Bureau.
   c. ☐ is not required, as the application was filed in the United States Receiving Office (RO/US)
6. ☒ A translation of the International Application into English (35 U.S.C. 371(c)(2)).
7. ☒ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3))
   a. ☐ are transmitted herewith (required only if not transmitted by the International Bureau).
   b. ☐ have been transmitted by the International Bureau.
   c. ☐ have not been made; however, the time limit for making such amendments has NOT expired.
   d. ☒ have not been made and will not be made.
8. ☐ A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
9. ☒ An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)). (Unsigned)
10. ☐ A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).

Items 11. to 16. below concern other document(s) or information included:

11. ☒ An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
12. ☐ An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
13. ☒ A **FIRST** preliminary amendment.
    ☐ A **SECOND** or **SUBSEQUENT** preliminary amendment.
14. ☐ A substitute specification.
15. ☐ A change of power of attorney and/or address letter.
16. ☒ Other items or information: Copies of International Search Report and Form PCT/RO/101.

EXPRESS NO. EL594609410US

U.S. APPLICATION NO. if known, see 37 CFR 1.[illegible] 09/719128	INTERNATIONAL APPLICATION NO. PCT/DE00/00935	[illegible]RNEY'S DOCKET NUMBER 10191/1566

17. ☒ The following fees are submitted:

Basic National Fee (37 CFR 1.492(a)(1)-(5)):
Search Report has been prepared by the EPO or JPO $860.00

International preliminary examination fee paid to USPTO (37 CFR 1.482) . . . $690.00

No international preliminary examination fee paid to USPTO (37 CFR 1.482) but international search fee paid to USPTO (37 CFR 1.445(a)(2)) $710.00

Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO $1,000.00

International preliminary examination fee paid to USPTO (37 CFR 1.482) and all claims satisfied provisions of PCT Article 33(2)-(4) $100.00

	CALCULATIONS	PTO USE ONLY
ENTER APPROPRIATE BASIC FEE AMOUNT =	$860	
Surcharge of $130.00 for furnishing the oath or declaration later than ☐ 20 ☐ 30 months from the earliest claimed priority date (37 CFR 1.492(e)).	$	

Claims	Number Filed	Number Extra	Rate		
Total Claims	9 - 20 =	0	X $18.00	$	
Independent Claims	2 - 3 =	0	X $80.00	$	
Multiple dependent claim(s) (if applicable)			+ $270.00	$	
TOTAL OF ABOVE CALCULATIONS =				$860	
Reduction by ½ for filing by small entity, if applicable. Verified Small Entity statement must also be filed. (Note 37 CFR 1.9, 1.27, 1.28).				$	
SUBTOTAL =				$860	
Processing fee of $130.00 for furnishing the English translation later the ☐ 20 ☐ 30 months from the earliest claimed priority date (37 CFR 1.492(f)). +				$	
TOTAL NATIONAL FEE =				$860	
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). $40.00 per property +				$	
TOTAL FEES ENCLOSED =				$860	
				Amount to be: refunded	$
				charged	$

a. ☐ A check in the amount of $_____ to cover the above fees is enclosed.

b. ☒ Please charge my Deposit Account No. 11-0600 in the amount of **$860.00** to cover the above fees. A duplicate copy of this sheet is enclosed.

c. ☒ The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. 11-0600. A duplicate copy of this sheet is enclosed.

NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.

SEND ALL CORRESPONDENCE TO:

Kenyon & Kenyon
One Broadway
New York, New York 10004

By: Richard L. Mayer (Reg. No. 41,172)
Richard L. Mayer
SIGNATURE

Richard L. Mayer, Reg. No. 22,490
NAME

12/7/00
DATE

324197

[10191/1566]

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Inventor(s)	:	Thomas SCHULTE et al.
Serial No.	:	To Be Assigned
Filed	:	Herewith
For	:	TEMPERATURE SENSOR HAVING AT LEAST ONE CONDUCTOR TRACK AND METHOD FOR THE MANUFACTURE OF A TEMPERATURE SENSOR
Examiner	:	To Be Assigned
Art Unit	:	To Be Assigned

Assistant Commissioner for Patents
Washington, D.C. 20231

PRELIMINARY AMENDMENT

SIR:

Kindly amend the above-identified application before examination, as set forth below.

IN THE SPECIFICATION:

Please amend the specification as follows:

On page 1, before line 1, insert:
--Field Of The Invention--.

On page 1, line 3, change "sensor according to the definition of the" to --sensor.--.

On page 1, delete line 4.

On page 1, delete line 6, and insert:
--Background Information--.

On page 1, delete blank line 7.

On page 1, line 8, delete "of this type".

EL594609410US

On page 1, line 13, change "coefficients. Prerequisite" to --coefficients. A prerequisite--.

On page 1, line 29, change "From the German DE 196 36 493 C1 it is known to fabricate" to --German Patent No. DE 196 36 493 describes the fabrication of--.

On page 2, delete line 7, and insert:
--Summary Of The Invention--.

On page 2, line 9, change "The" to --In the--.

On page 2, line 11, change "sensor having the features of Claims 1 and 5," to --sensor,--.

On page 2, line 12, delete "respectively, are characterized in that".

On page 2, line 13, change "resistances can be" to --resistances are--.

On page 2, line 16, after "carrier" insert
--(substrate)--.

On page 3, delete lines 3-17.

On page 3, before line 18, insert:
--Brief Description Of The Drawings
Figure 1 shows a schematic plan view of a temperature sensor.

Figure 2 shows a schematic sectional view of conductor track particles of the temperature sensor.

Detailed Description--.

On page 5, delete line 1, and insert:

--What Is Claimed Is:--.

IN THE ABSTRACT:

Please amend the abstract as follows:

Delete line 1, and insert:

- -Abstract Of The Disclosure- -.

Delete line 3, and insert --A temperature sensor includes--.

Line 5, after "and" insert --evaluated. The--.

Delete lines 6-7.

Line 8, delete "The" and "(14)".

Line 9, delete "(24)".

Delete line 12.

IN THE CLAIMS:

Please cancel claims 1-8, without prejudice.

Please add the following new claims:

9. (New) A temperature sensor comprising:

a carrier having a surface composed of at least one of a metal oxide, a metal carbide and a metal nitride; and

at least one conductor track composed of a metal, the at least one conductor track covering the surface of the carrier, a temperature-dependent change in a resistance of the at least one conductor track being measured and evaluated.

10. (New) The temperature sensor according to claim 9, wherein the corner is composed of at least one of zirconium dioxide and aluminum oxide.

11. (New) The temperature sensor according to claim 9, wherein the at least one conductor track is composed of one of cobalt, nickel, copper and platinum.

12. (New) The temperature sensor according to claim 9, wherein an a.c. voltage is applied to the at least one conductor track to determine the resistance.

13. (New) The temperature sensor according to claim 9, wherein the temperature sensor is situated in a layer of a laminated layer sensor.

14. (New) A method for manufacturing a temperature sensor comprising the step of:

forming at least one conductor track by a currentless deposition of a metal onto a surface of a carrier and by a subsequent thermal treatment, the carrier being composed of at least one of a metal oxide, a metal nitride and a metal carbide, a temperature-dependent change in a resistance of the at least one conductor track being measured and evaluated by the temperature sensor.

15. (New) The method according to claim 14, wherein a layer thickness of a metal layer situated on the surface of the carrier is determined by at least one of a duration and a selected temperature during a thermal treatment.

16. (New) The method according to claim 14, wherein the carrier is used as a powder.

17. (New) The method according to claim 14, wherein the temperature sensor is situated in a layer of a laminated layer sensor.

REMARKS

This Preliminary Amendment cancels, without prejudice, claims 1-8 in the underlying PCT application PCT/DE00/00935. The new claims, inter alia, conform the claims to U.S. Patent and Trademark Office rules and do not add new matter to the application.

The above amendments to the specification and the abstract conform the specification and the abstract to U.S. Patent and Trademark Office rules, and do not introduce new matter into the application.

The underlying PCT application PCT/DE00/00935 includes an International Search Report, dated July 11, 2000. An English translation of the Search Report is provided herewith.

It is respectfully submitted that the subject matter of the present application is new, non-obvious, and useful. Prompt consideration and allowance of the application are respectfully requested.

Respectfully submitted,

By D. Magath (Reg. No. 41,172)

Dated: 12/7/00

By: Richard L. Mayer
Richard L. Mayer
Reg. No. 22,490

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324403

TEMPERATURE SENSOR HAVING AT LEAST ONE CONDUCTOR TRACK AND METHOD FOR THE MANUFACTURE OF A TEMPERATURE SENSOR

The present invention relates to a temperature sensor having at least one conductor track and to a method for manufacturing such a temperature sensor according to the definition of the species in Patent Claim 1 and 5, respectively.

Background of the Present Invention

Temperature sensors of this type are known. They usually have a conductor track, where a temperature-dependent change in a resistance of the conductor track is measured and evaluated. In this context, such a conductor track can be made from a cermet, because cermets are characterized by their especially large resistance temperature coefficients. Prerequisite for measuring the resistance is an existing conductivity.

The known method has the disadvantage that the conductivity of cermets is limited to resistances in the ohm-range. However, a measurement, in which the conductor track exhibits resistances having several hundred ohms is especially favorable for an error-free measurement of the temperature changes. The resistance can, in fact, be increased by reducing the volumetric component of the metal in the cermet, yet the cermet becomes non-conducting below a certain percolation limit. To obtain higher resistances, the conductor track in the known cermet-based temperature sensors is lengthened, thereby rendering it impossible to obtain high resistances in small spaces.

From the German DE 196 36 493 C1 it is known to fabricate a spark plug resistor using a currentless deposition of a metal

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onto glass or ceramic powder. However, such a spark plug resistor has a resistance range of several thousand ohms and is designed to withstand loads that occur as a result of an applied high voltage. A disadvantage in this context is that manufacture is consequently complicated and expensive.

Advantages of the Present Invention

The temperature sensor in accordance with the present invention and the method for the manufacture of such a temperature sensor having the features of Claims 1 and 5, respectively, are characterized in that conductor tracks having high resistances can be manufactured in a simple, cost-effective manner. Due to the fact that the conductor tracks are formed of a metal, which covers one surface of a carrier made of a metal oxide, carbide, or nitride, the resistance is simply determined by one thickness of the metal layer, thereby eliminating the restriction under known methods heretofore of the percolation limit.

Especially advantageous is a high variability of the metal used. A currentless bath is used for the metal deposition process to force the metal onto the carrier. Subsequent thermal treatment then leads to the compression of the moistened areas on the surface of the carrier, thereby creating a conductive layer. Usable metals include cobalt, nickel, copper, platinum, and others.

Ceramic particles, in particular metal oxides, metal carbides, or metal nitrides, such as aluminum oxide or zirconium dioxide, can be used as carriers, zirconium dioxide being particularly suitable for the manufacture of laminated layer sensors. To ensure the functionality of such layer sensors, an exact temperature measurement is often necessary. The temperature sensor in accordance with the present invention only requires a small amount of space and is distinguished by a resistance range that is favorable for temperature

measurements.

Additional preferred refinements of the present invention are derived from the remaining features recited in the dependent claims.

Drawings

The present invention is further elucidated in the following using an exemplary embodiment based on the corresponding drawing, whose figures show:

Figure 1 a schematic plan view of a temperature sensor; and

Figure 2 a schematic sectional view of conductor track particles of the temperature sensor.

Description of the Exemplary Embodiment

Figure 1 illustrates one possible specific embodiment of a temperature sensor 10 according to the present invention. Such a temperature sensor 10 can, for example, be a functional element of a laminated layer sensor. In this case, the sensor has a layer 12, in which a conductor track 14 is embedded that is connected, in turn, via two contact points 16 to an evaluation device not depicted here.

A temperature can be determined by measuring a resistance of conductor track 14. Conductor track 14 is preferably loaded with an a.c. voltage.

If temperature sensor 10 is used in the layer sensor, then conductor track 14 is usually made of a metal oxide, such as zirconium dioxide or aluminum oxide, and of a metal such as platinum.

Figure 2 shows a schematic cross-section of two particles 20 which constitute part of the conductor track 14. Particles 20 include an inner core 22, a boundary layer 28, and an outer

metal layer 26 disposed on a surface 24. Such a particle 20 can be described as follows:

A carrier made of a metal oxide, metal carbide, or metal nitride, which is used as a powder having a selectable grain size, is used as the base material. One single grain of the carrier has surface 24. Especially suited are zirconium dioxide and aluminum oxide grains.

Palladium nuclei, which are used as seed crystals for the currentless deposition of the metals, which are to later form metal layer 26, are initially deposited by reduction on surface 24. The currentless deposition of metals according to this process is generally known and will, therefore, not be more closely explained within the framework of this present description. Metals, such as cobalt, nickel, copper, or platinum, can be deposited.

Once the metals are deposited on surface 24, they undergo a thermal treatment. On the one hand, the treatment compresses and permanently joins metallic layer 26 to surface 24, and, on the other hand, a conductive layer is thereby created, which is represented by conductor track 14, in that adjacent particles 20 in the region of metallic layer 26 fuse together.

The metal can diffuse into carrier grain 22 during the thermal treatment, thereby forming boundary layer 28. A layer thickness d of metal layer 26 can be influenced by the duration of the treatment and the temperature level.

The resistance of such a conductor track 14 is essentially dependent upon metal layer 26. In this context, metal layer 26 represents a layer resistance, whose magnitude is determined by layer thickness d, which is a measure of the conductor track cross-section. By reducing layer thickness d, one can increase the resistance of conductor track 14.

Claims

1. A temperature sensor having at least one conductor track, a temperature-dependent change in a resistance of the conductor track being measured and evaluated, characterized in that the conductor track (14) is made of a metal, which covers a surface (24) of a carrier made of a metal oxide, metal carbide, or metal nitride.

2. The temperature sensor as recited in Claim 1, characterized in that the carrier is made of zirconium dioxide and/or aluminum oxide.

3. The temperature sensor as recited in one of the preceding claims, characterized in that the metal is cobalt, nickel, copper, or platinum.

4. The temperature sensor as recited in one of the preceding claims, characterized in that to determine the resistance, an a.c. voltage can be applied to the conductor track (14).

5. A method for manufacturing a temperature sensor having at least one conductor track, a temperature-dependent change in a resistance of the conductor track being measured and evaluated by the temperature sensor, characterized in that the conductor track (14) is formed by the currentless deposition of a metal onto a surface (24) of a carrier made of a metal oxide, metal nitride, or metal carbide and by a subsequent thermal treatment.

6. The method as recited in Claim 5, characterized in that a layer thickness (d) of a metal layer (26) disposed on the surface (24) of the carrier is determined by the duration and/or selected temperature during a thermal treatment.

7. The method as recited in Claims 5 and 6, characterized in that the carrier is used as a powder.

8. The use of a temperature sensor as recited in one of Claims 1 through 7 in a layer (12) of a laminated layer sensor.

Abstract

The present invention relates to a temperature sensor having at least one conductor track, a temperature-dependent change in a resistance of the conductor track being measured and evaluated.

The conductor track (14) is made of a metal, which covers a surface (24) of a carrier made of a metal oxide, metal carbide, or metal nitride.

(Figure 1)

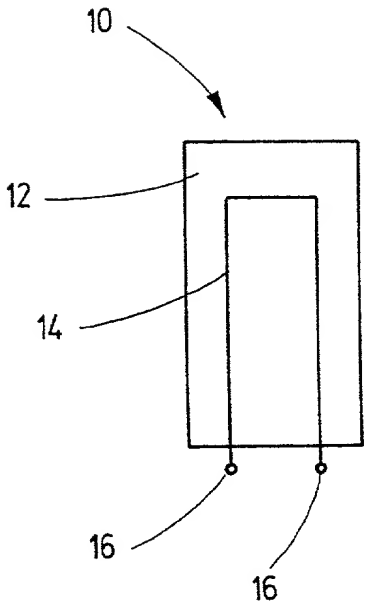

Fig. 1

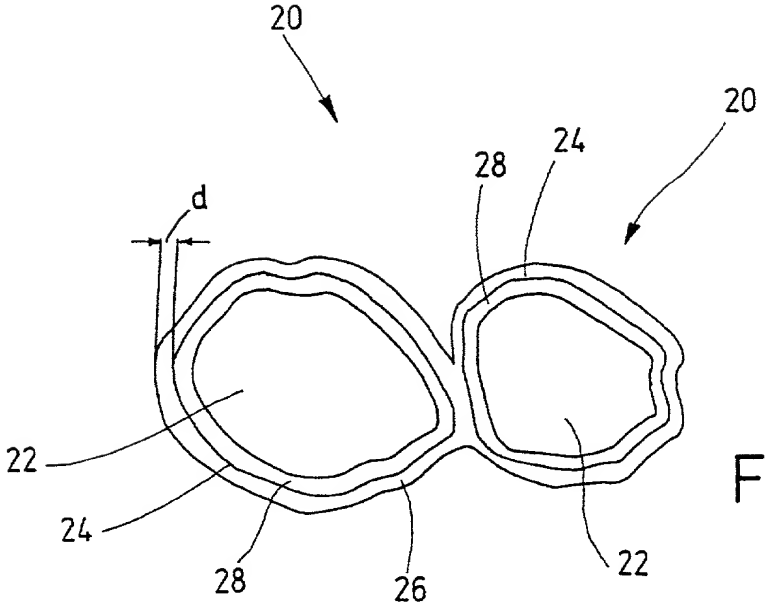

Fig. 2

#3

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COMBINED DECLARATION AND
POWER OF ATTORNEY FOR PATENT APPLICATION

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below adjacent to my name.

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled **TEMPERATURE SENSOR HAVING AT LEAST ONE CONDUCTOR TRACK AND METHOD FOR THE MANUFACTURE OF A TEMPERATURE SENSOR**, and the specification of which:

[ ] is attached hereto;

[ ] was filed as United States Application Serial No. _____ on _____, 19__ and was amended by the Preliminary Amendment filed on _____, 19__.

[x] was filed as PCT International Application Number PCT/DE00/00935, on the 28th day of March, 2000

[x] an English translation of which is filed herewith.

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to the examination of this application in accordance with Title 37, Code of Federal Regulations, §1.56(a). I hereby claim foreign priority benefits under Title 35, United States Code § 119 of any foreign application(s) for patent or inventor's certificate or of any PCT international applications(s) designating at least one country other than the United States of America listed below and have also identified below any foreign application(s) for patent or inventor's certificate or any PCT international application(s) designating at least one country other than the United States of America

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filed by me on the same subject matter having a filing date before that of the application(s) of which priority is claimed:

PRIOR FOREIGN/PCT APPLICATION(S)
AND ANY PRIORITY CLAIMS UNDER 35 U.S.C. § 119

Country : Federal Republic of Germany

Application No. : 199 15 525.9

Date of Filing: 7 April 1999

Priority Claimed
Under 35 U.S.C. § 119 : [x] Yes [ ] No

I hereby claim the benefit under Title 35, United States Code § 120 of any United States Application or PCT International Application designating the United States of America that is/are listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in that/those prior application(s) in the manner provided by the first paragraph of Title 35, United States Code § 112, I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations § 1.56(a) which occurred between the filing date of the prior application(s) and the national or PCT international filing date of this application:

PRIOR U.S. APPLICATIONS OR
PCT INTERNATIONAL APPLICATIONS
DESIGNATING THE U.S. FOR BENEFIT UNDER 35 U.S.C. § 120

U.S. APPLICATIONS

Number :

Filing Date :

PCT APPLICATIONS
DESIGNATING THE U.S.

PCT Number :

PCT Filing Date :

I hereby appoint the following attorney(s) and/or agents to prosecute the above-identified application and transact all business in the Patent and Trademark Office connected therewith.

(List name(s) and registration number(s)):

(2)

Richard L. Mayer, Reg. No. 22,490
Gerard A. Messina, Reg. No. 35,952

All correspondence should be sent to:

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I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment or both under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

1-00

Full name of inventor **Thomas SCHULTE**

Inventor's signature _____ Date 7. November 2000

Citizenship Federal Republic of Germany

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2-00

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Inventor's signature Thomas Brinz Date Nov. 8,

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3-00

Full name of inventor **Lothar WEBER**

Inventor's signature Lothar Weber Date 10. Nov. 2000

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